OLLSCOIL NA hËIREANN GAILLIMH

NATIONAL UNIVERSITY OF IRELAND GALWAY

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SUMMER EXAMINATIONS 2009

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Bachelor of Science in Information Technology

ARTIFICIAL INTELLIGENCE (CT421) - 4IF1

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Time allowed: *three* hours.
Attempt *two* questions from section A AND *two* questions from section B.

SECTION A

1. (a) Write the following Prolog predicates:
   (i) square(X,Y). where Y is the square of X, e.g.:
   :-square(5,Y).
   Y = 25
   Explain how your predicate would respond to the following query:
   :-square(A,36).
   (7 marks)
   (ii) sumlist(List,Sum). where Sum is the sum of the elements in the list List. e.g.:
   :-sum([1,2,3],X).
   X = 6
   (9 marks)

   (b) Explain what is meant by the "Closed World Assumption" in Prolog, pay particular attention to its advantages and disadvantages.
   (9 marks)

2. Write Prolog predicates to do the following:

   (a) reverse(L1,L2). where L2 is reverse of list. e.g.:
   :-reverse([a,b,a,c],Res).
   gives the result
   Res = [c,a,b,a].
   (12 marks)

   (b) subset(L1,L2). where list L1 is a subset of list L2, e.g.:
   :-subset([a,b],[c,b,a]).
   gives the result
   yes
   (Hint: use the member predicate)
   (13 marks)

3. (a) Explain what is meant by Qualitative Reasoning. What are its advantages and disadvantages.
(4 marks)

(b) Give an example of an application where Qualitative Reasoning would be suitable. Justify your answer.
(3 marks)

(c) Give an example of an application where Qualitative Reasoning would not be suitable. Justify your answer.
(3 marks)

(d) Given the following constraints (which represent the motion of a ball being thrown in the air):

$$DERIV(x, v)$$
$$DERIV(v, a)$$
$$a = g < 0$$

and the quantity spaces:

$$\{-\infty, 0, \infty\}\ for\ v$$
$$\{0, top\}\ for\ x$$

If the initial state is:

$$QS(x, t_1) =< top, std >$$
$$QS(v, t_1) =< 0, dec >$$
$$QS(a, t_1) =< g, std >$$

What are the possible next states? (Show your workings)

Rule-id	$QS(v, t_i)$	$QS(v, t_i, t_{i+1})$
P1	$< l_i, std >$	$< l_i, std >$
P2	$< l_i, std >$	$< (l_i, l_{i+1}), inc >$
P3	$< l_i, std >$	$< (l_{i-1}, l_i), dec >$
P4	$< l_i, inc >$	$< (l_i, l_{i+1}), inc >$
P5	$< (l_i, l_{i+1}), inc >$	$< (l_i, l_{i+1}), inc >$
P6	$< l_i, dec >$	$< (l_{i-1}, l_i), dec >$
P7	$< (l_i, l_{i+1}), dec >$	$< (l_i, l_{i+1}), dec >$

(10 marks)

(e) What discrete states would the ball pass through after being thrown up into the air?
(5 marks)

SECTION B

4. (a) Explain in your own words what is meant by the following three terms: 'topic-driven dialogue engine', 'event-driven dialogue engine', 'Eliza-like engine'.
   (12 marks)

   (b) Discuss the development of a simple commentary engine to accompany a card game. The engine should be based on finite state machines and admit of at least two parties to the commentary.
   (13 marks)

5. (a) What is your understanding of the term 'genetic algorithm'?
   (5 marks)

   (b) Is a genetic approach to a search problem guaranteed to succeed?
   (5 marks)

   (c) Discuss a genetic programming approach to evolving a simple population of plants, explaining all assumptions you make. Give particular consideration to the design of a suitable fitness function, based on a suitable number of environmental conditions.
   (15 marks)

6. "Artificial Intelligence is likely to contribute more and more towards game development"
   Discuss this statement
   (25 marks)